

Green Fuels from Biomass Resources: Solutions for Land Management in Western US



Jim Rekoske / Jim Andersen
Utah Energy Conference
10-11 January 2013

Uop
A Honeywell Company
Honeywell

Honeywell International

Honeywell

- \$36.5 billion (2011) in revenues, 50% outside of U.S.
- Nearly 130,000 employees operating in 100 countries
- Morristown, NJ global corporate headquarters

Aerospace



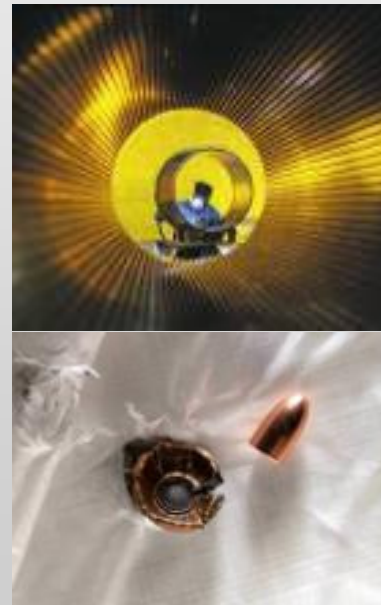
\$11.5B

Automation & Control Solutions



\$15.5B

Performance Materials & Technologies



\$5.7B

Transportation Systems



\$3.9B

UOP LLC, A Honeywell Company

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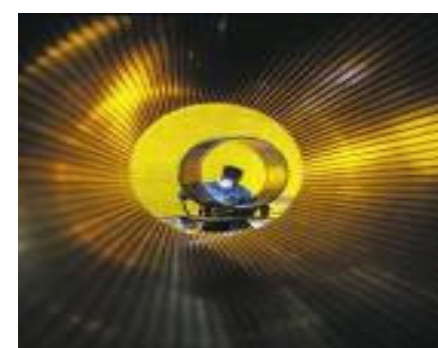
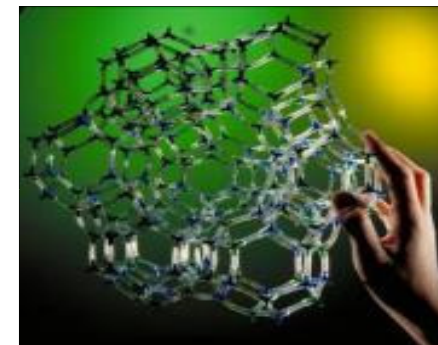
- Founded in 1914
- A leading international supplier and licensor of processing technology, catalysts, adsorbents, process plants, and technical services.
- Largest process licensing organization in the world.
- 31 out of 36 refining technologies in use today were developed by UOP

Markets

- Petroleum refining
- Petrochemical production
- Gas processing
- Renewable fuels and chemicals

Products/Services

- Developing and licensing of process technology
- Equipment
- Catalysts
- Adsorbents
- Molecular sieves



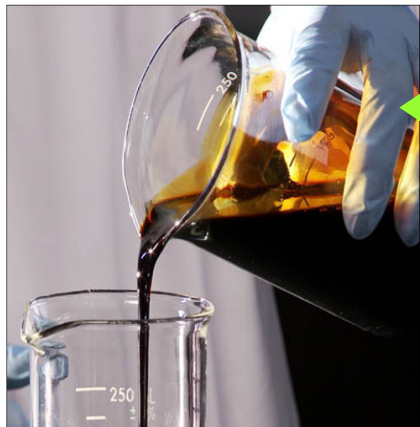
We've Known Hydrocarbon Fuels for 100 Years!

RTP™ Technology for Renewable Liquid Fuels

Honeywell



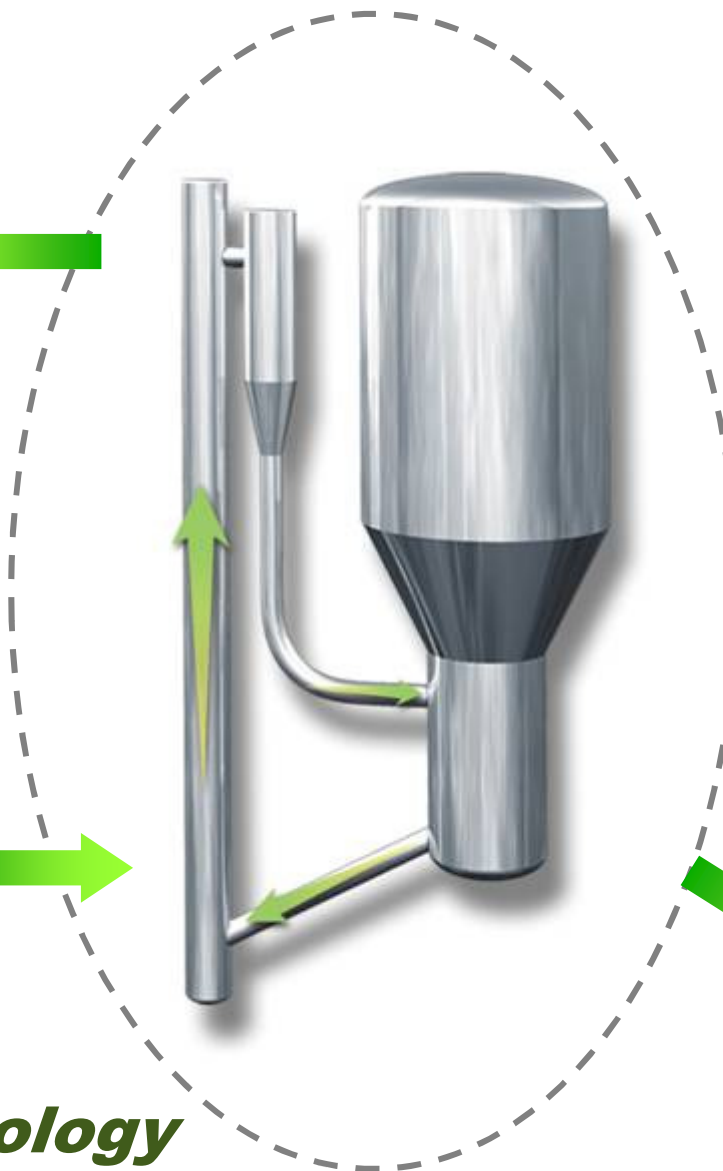
RTP Green Fuel



Solid Biomass



Proven Technology



- 950 °F (510 °C), <2 seconds
- Biomass converted to liquid pyrolysis oil
- Fast fluidized bed, sand as heat carrier
- High yields; ~70 wt% liquid on woody biomass
- Light gas and char by-product provide heat to dry feed and operate unit



RTP History and Commercial Experience

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- Commercialized in the 1980's
- 7 units designed and operated in the US & Canada
- Continuous process with >90% availability

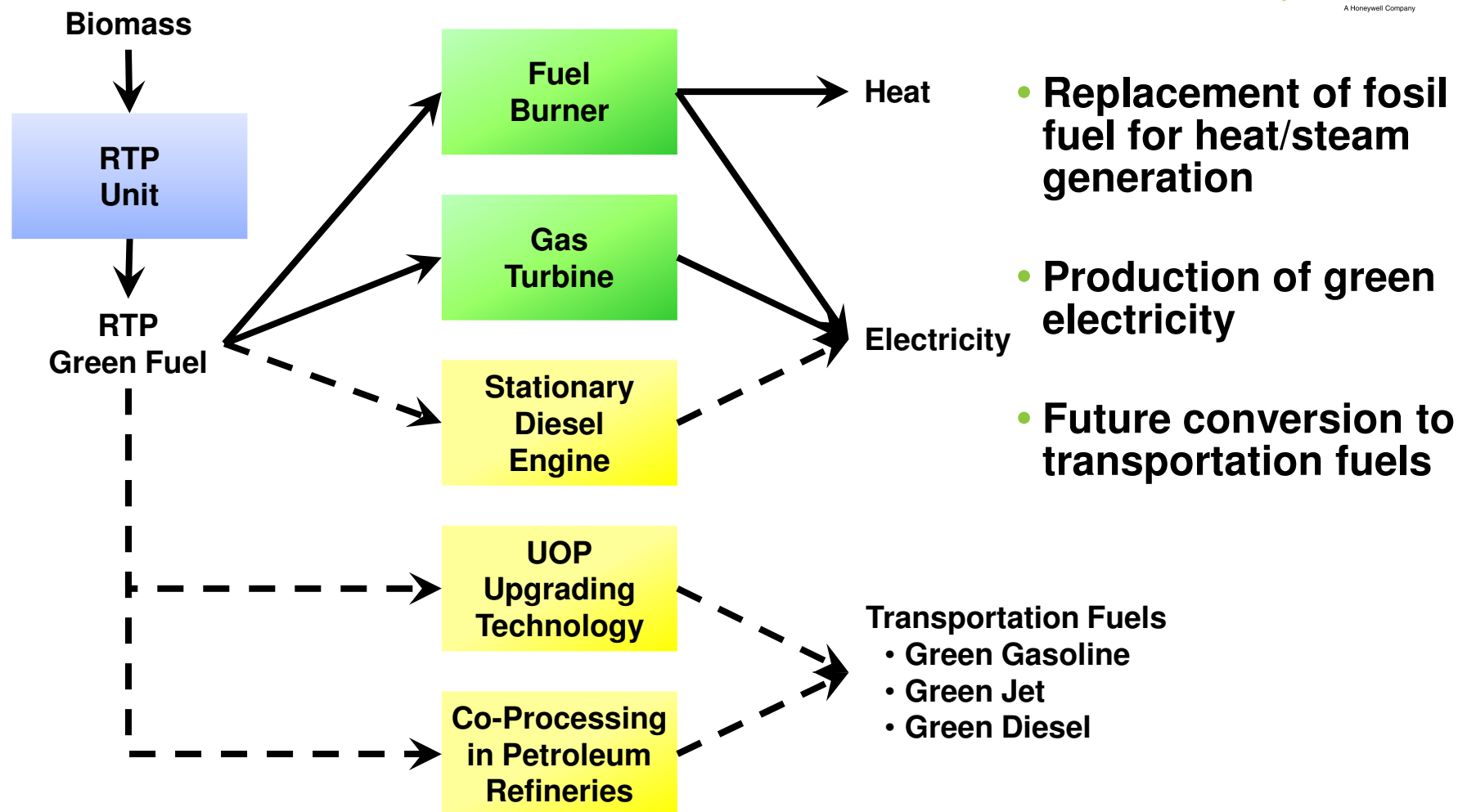
<i>Plant</i>	<i>Year Built</i>	<i>Operating Capacity (Metric Tonnes Per Day)</i>	<i>Location</i>
Manitowoc RTP™ – 1	1993	30	Manitowoc, WI, USA
Rhinelanders RTP™ – 1	1995	35	Rhinelanders, WI, USA
Rhinelanders Chemical #2	1995	2	Rhinelanders, WI, USA
Rhinelanders RTP™ – 2	2001	45	Rhinelanders, WI, USA
Rhinelanders Chemical #3	2003	1	Rhinelanders, WI, USA
Petroleum Demo # 1	2005	300 barrels per day	Bakersfield, CA, USA
Renfrew RTP™ – 1	2007	100	Renfrew, Ontario, Canada

New Projects:

<i>Year of Project</i>	<i>Technology</i>	<i>Location</i>	<i>Customer</i>	<i>Size (TPD)</i>
2009	RTP	Italy	INDI	150
2012	RTP	North America	Undisclosed	400
2012	RTP	Malaysia	Premium / Felda JV	400
2012	RTP	Finland	Green Fuel Nordic	400

Markets / Uses for RTP Green Fuel

Honeywell



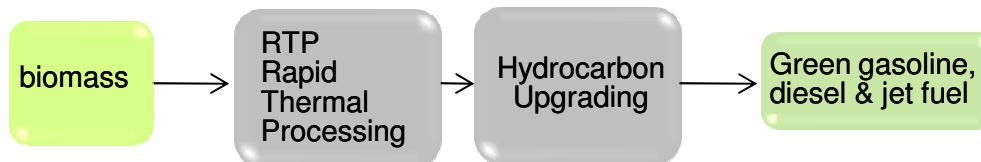
Multiple Applications are Available for RTP Green Fuel

IBR – Biomass to Transportation Fuel Pilot

Honeywell



- Pilot-scale conversion of biomass into liquid transportation fuels
- Located at the Tesoro Refinery in Kapolei, HI
- Backed by a \$25 million award from the U.S. Department of Energy
- Utilizes a wide range of locally available biomass (switchgrass, algae, forest and agricultural residuals)
- Commercial units could create up to 800 construction jobs and 1,000 new jobs in biomass production and refinery operations
- Greater than 60% reduction in greenhouse gas emissions
- Phase 1 Completed in 2012
- Fully Operation - 2014



Making Cellulosic Biofuels a Reality

Summary

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- **Production of Green Fuel from woody biomass residues is a reality today**
 - Commercially-proven technology generates energy-dense, low sulfur fuel
 - Creates value-added products from waste / invasive raw material
 - Similar forestry management projects underway in Europe
- **Markets for Green Fuel are increasing**
 - Renewable fuel oil (RFO) which competes with petroleum fuel oil without subsidy available today
 - Strong drivers at mining, industrial sites without access to natural gas
 - Co-processing in suitable petroleum refineries
 - Production of firm, renewable electricity from stationary diesel engines in late 2013
 - Cellulosic biofuels from RTP Green Fuel Upgrading at parity with petroleum-derived gasoline and distillates in 2014

UOP Continues to Develop and License Innovative Technologies for Renewable Fuel and Energy

